

On-Orbit Health Monitoring and Repair Assessment of Thermal Protection Systems, Phase II

Completed Technology Project (2005 - 2007)



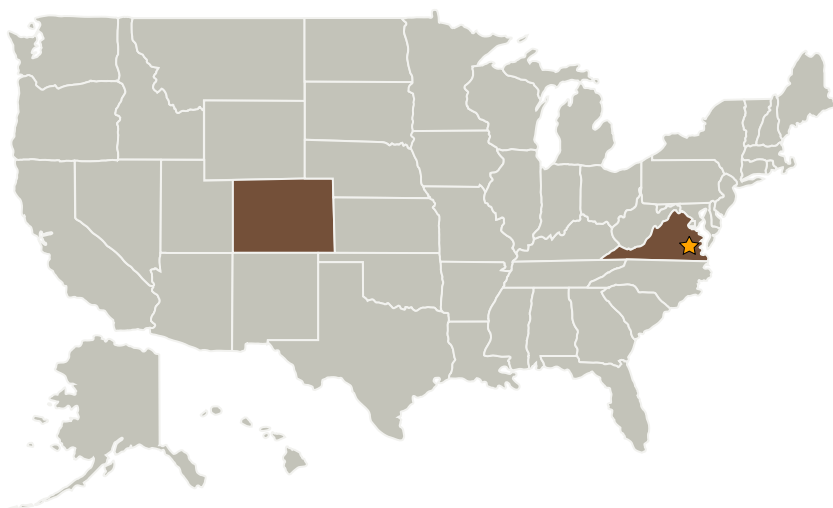
Project Introduction

This SBIR project delivers On-orbit health MoNItoring and repair assessment of THERMal protection systems (OMNI_THERM). OMNI_THERM features impedance-based structural health monitoring (SHM) and uses miniaturized autonomous sensor/actuators to diagnose damage and verify repair efficacy. Implications of the innovation Thermal protection systems (TPS) are crucial for crew safety. New techniques of on-orbit assessment of TPS are needed to accelerate Crew Exploration Vehicle (CEV) development. An autonomous impedance-based SHM system is one of the few viable solutions; Phase I established that this technique can be configured for on-orbit TPS health monitoring. Technical objectives We will configure OMNI_THERM for on-orbit SHM through iterative hardware refinements combined with environmental testing and demonstrations at CEV contractors. OMNI_THERM deploys autonomous, wireless, self-powered sensor/actuators. Each sensor/actuator is a self-contained SHM system; this computationally distributed framework minimizes single points-of-failure. Research description Phase I produced an advanced prototype and demonstrated SHM on TPS. Phase II includes miniaturization and expands to higher temperature ranges, hybrid structures, and advanced composites. Anticipated results Phase II delivers an OMNI_THERM system configured for on-orbit SHM and repair assessment of TPS and other crucial structures. System development includes ruggedization, scaling to multiple sensors, self-diagnostics, high temperature (>500

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F) and system validation, and autonomous operation.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Extreme Diagnostics, Inc.	Supporting Organization	Industry	Boulder, Colorado

Primary U.S. Work Locations

Colorado	Virginia
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.3 Thermal Protection Components and Systems
 - └ TX14.3.5 Thermal Protection System Instrumentation